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| | <p align="center">Effective Date: 8-August-2005</p> |
| <p>APPENDIX C: CALIBRATION OF THE BIOMEK®2000 AUTOMATION WORKSTATION</p> <p>Calibration tests should be performed on a routine basis for the BioMek®2000 Automation Workstation. The Position Calibration MUST be performed weekly and the Base Module, Left Side Module and the Shaker/Thermal Exchange Unit alignments Must be performed monthly.</p> <p>1 POSITION CALIBRATION</p> <p>1.1 Open the BioWorks folder on the desktop. Icons for different programs will be visible.</p> <p>1.2 Double click on the Diagnostics icon or highlight the Diagnostics icon and under “File” in the drop down menu, select “Open”.</p> <p>1.3 A window will open showing a menu with the following choices: Align, Diagnose, View, Download and Help.</p> <p>1.4 Select Align and a drop down menu will appear with the following choices: Work surface, Stacker Carousel, Position Calibrate, Gripper and Edit.</p> <p>1.5 Select Position Calibrate and the robot will automatically perform the test. The robot will indicate whether or not the calibration is done (a box will appear stating that the position calibration is done. Click OK) or whether the robot failed the test (a box will appear stating that the robot failed the test). If the robot failed the test, repeat it. If the robot fails three times in a row, a service technician must be called to repair the robot.</p> | |

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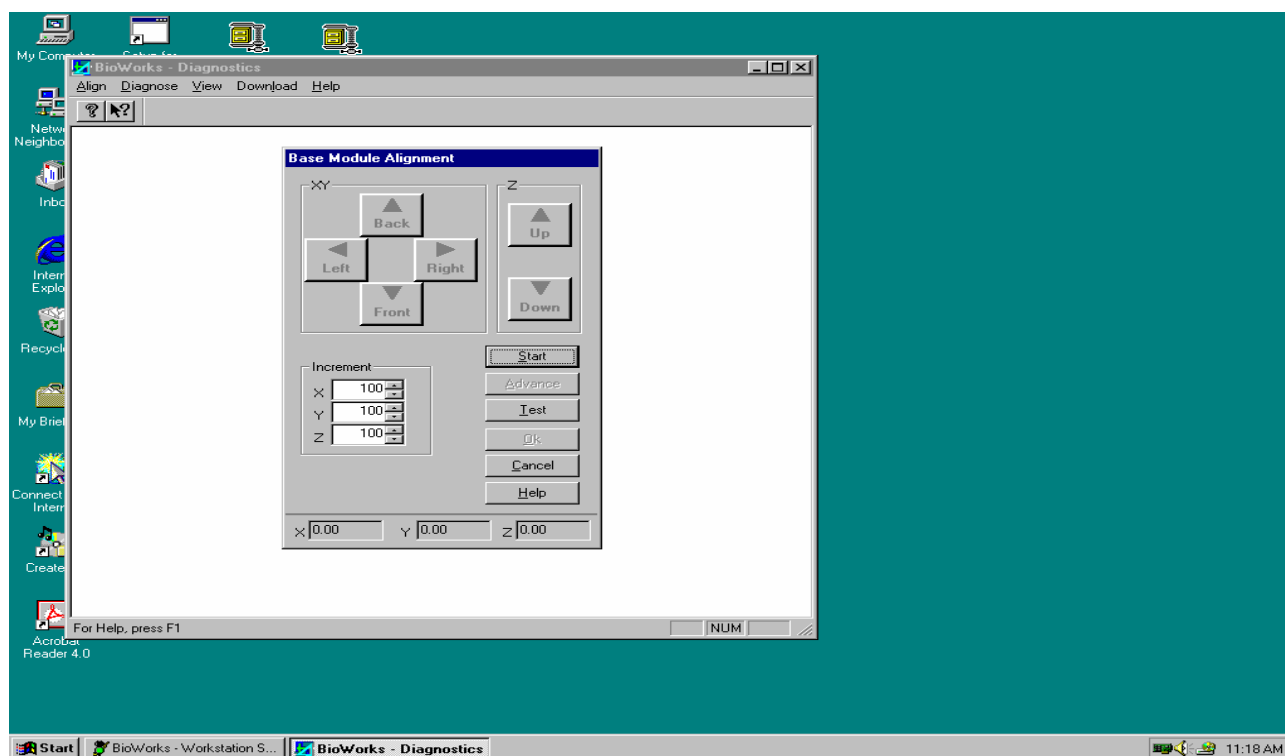
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2 BASE MODULE ALIGNMENT

- 2.1 Click on the Align function in the Diagnostics program and the drop down window will appear. Select Worksurface and another drop down menu will appear giving the following selections: Base Module, Left Side Module and Right Side Module. Choose the Base Module. A window will open (shown below).



- 2.2 Click on Start. A window will open asking the user to place a LabWare Holder (gray clamp for this test) at position A2. After doing so, click OK. A message will come up asking the user to place the Alignment probe on the head. The Alignment probe is red in color and must be manually placed onto the head.
- 2.3 Depress the black button on the front of the head and align the pins of the Alignment probe so that they fit into the robot head. Pay attention the “Front” label and arrow pointing to the front direction on the probe to ensure that it is placed on the head correctly.
- 2.4 Place a single Beckman P20 tip onto the probe, then click OK and the program will initiate. The probe with tip will align over the target on a gray clamp first at position A2.
- 2.5 A window will appear asking if it is safe to move down 3 mm. If it is, click “Yes”, otherwise click “No”.
- 2.6 A window will appear saying “Move to the alignment point, click on ‘Advance’ when in place”, click OK.

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| 2.7 | The tip should be perfectly centered over the target and only a Post-It-Note should be able to be slipped between the tip on the probe and the target. It should be a tight fit, with some resistance when pulling out the Post-It-Note from underneath the tip. | |
| 2.8 | If adjustment is necessary at the X, Y or Z axes, then click on the appropriate arrow to move the probe in the correct direction. The increment value ranges from 10 to 100, with 100 being the default. For fine adjustments, the 10 value should be used. | |
| 2.9 | Once the tip has been successfully aligned, then click “Advance” and the Alignment probe will continue on to targets at B2, A5 and B5. | |
| 2.10 | Once all alignments have been performed, click OK and those values will be saved. | |
| 2.11 | A window will appear requesting that the Alignment probe be removed from the head. Click OK and the alignment will be finished. | |
| 3 | LEFT SIDE MODULE ALIGNMENT | |
| 3.1 | Click on the Align function in the Diagnostics program and the drop down window will appear. Select Worksurface and another drop down menu will appear giving the following selections: Base Module, Left Side Module and Right Side Module. Choose the Left Side Module. A window will open (similar to the window shown above for the Base Module Alignment). | |
| 3.2 | Click on Start. A window will open asking the user to place a LabWare Holder (gray clamp for this test) at position A1. After doing so, click OK. A message will come up asking the user to place the Alignment probe on the head. The Alignment probe is red in color and must be manually placed onto the head. | |
| 3.3 | Depress the black button on the front of the head and align the pins of the Alignment probe so that they fit into the robot head. Pay attention that the “Front” label and arrow are pointing to the front direction on the probe to ensure that it is placed on the head correctly. | |
| 3.4 | Place a single Beckman P20 tip onto the probe, then click OK and the program will initiate. The probe with tip will align over the target on a gray clamp first at position A1. | |
| 3.5 | A window will appear asking if it is safe to move down 3 mm. If it is, click “Yes”, otherwise click “No”. | |
| 3.6 | A window will appear saying “Move to the alignment point, click on ‘Advance’ when in place”, click OK. | |
| 3.7 | The tip should be perfectly centered over the target and only a Post-It-Note should be able to be slipped between the tip on the probe and the target. It should be a tight fit, with some resistance when pulling out the Post-It-Note from underneath the tip. | |
| 3.8 | If adjustment is necessary at the X, Y or Z axes, then click on the appropriate arrow to move the probe in the correct direction. The increment value ranges from 10 to 100, with 100 being the default. For fine adjustments, the 10 value should be used. | |

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| <div data-bbox="248 323 1533 695"> <p>3.9 Once the tip has been successfully aligned, then click “Advance” and the Alignment probe will continue on to another point at A1. There is no target at the second point, so just position the Z axis, then click “Advance”.</p> <p>3.10 A window will come up asking the user to a LabWare Holder (gray clamp) at position B1. After doing so click OK and continue with the alignment over the target at position B1.</p> <p>3.11 Once all alignments have been performed, click OK and those values will be saved.</p> <p>3.12 A window will appear requesting that the Alignment probe be removed from the head. Click OK and the alignment will be finished.</p> </div> <div data-bbox="152 762 941 793"> <p>4 SHAKER-THERMAL EXCHANGE UNIT ALIGNMENT</p> </div> <div data-bbox="248 831 1533 1297"> <p>4.1 This alignment program is not found in the Diagnostics folder, but is instead a method written specifically for alignment of the labware holders on the shaker. In the BioWorks folder, double click on the Edit Icon.</p> <p>4.2 Once in the Edit function, either use the drop-down window under Method or click on the open folder icon.</p> <p>4.3 Once the Open Method window is open, highlight Shaker Alignment and double click or click on open.</p> <p>4.4 The method will open in the edit mode. A window with the BioMek surface will open which shows a P250 tip box on the deck as well as a Greiner plate at the MM5 Shaker Front R position (front position on the shaker) and a Greiner plate at the Shaker Heat Block (back position on the thermal exchange unit). See below.</p> </div> | |

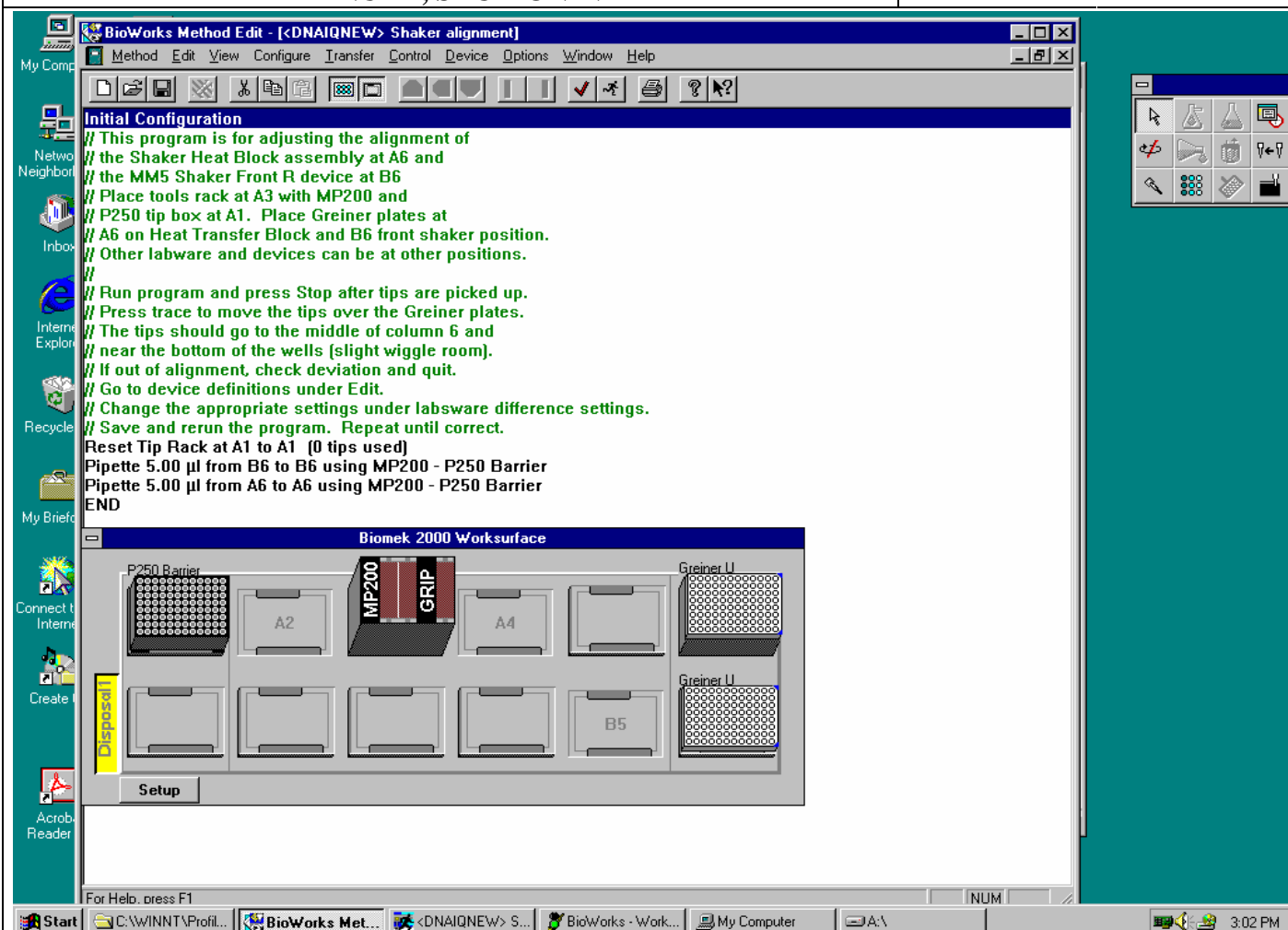
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- 4.5 Click on the running man icon to initiate the method.
- 4.5 A window will open showing the BioMek worksurface. Click on the Accept All button. The method will then begin.
- 4.6 As soon as the robot arm picks up a column of tips and is moving over to the Greiner plate, click on the stop button which appears in the method window. The robot will not immediately stop, but will finish that step. The robot arm will end up with the tips positioned just above the Greiner plate.
- 4.7 Verify that the tips won't crash into the top of the Greiner plate, but will instead go into the wells before continuing to the next step. If it appears as if the tips will hit the top of the plate, then click the Quit button and go to step 4.13.
- 4.8 Click on the Trace button twice. The tips will then go down into the Greiner plate wells and stop. Check the tip alignment in the wells from the front (X-axis) and the side (Y-axis). Tips should be centered in the wells. However, at the Y-axis, the outermost wells (rows A and H, the tips will be offset from the center, with the tip in row A aligning a little closer to the back and the tip in row H

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| <p>aligning a little closer to the front. The center most tips at rows E and F are the only tips that should be perfectly aligned at the Y-axis. The Z-axis is assessed by pulling up on the plate to evaluate the “wobble room”. The plate should be able to be moved up from the base of the labware holder by about 1 mm.</p> <p>4.9 If the tips need to be adjusted for any of the axes, then click on the Quit button and go to step 4.13. Otherwise, click on Continue.</p> <p>4.10 Very quickly, the tips will move up and down in the Greiner plate and then the arm will move the tips to the rear position, to the Shaker Heat Block. As soon as the tips become airborne, click on the Stop button. Again the tips will stop just over the Greiner plate at the Shaker Heat Block position.</p> <p>4.11 If the tips won’t hit the top of the Greiner plate, but will instead go into the wells, click twice on the Trace button. If the tips will hit the plate, then click on Quit and go to step 4.19.</p> <p>4.12 After the Trace button has been clicked twice, the tips will move into the wells and stop. Evaluate the tip alignment at the X, Y and Z axes for the Shaker Heat Block in the same manner as described in step 4.9. If adjustments need to be made, click on Quit and go to step 4.19. If the alignment at all axes is good, then click Continue and the method will terminate and the alignment will be finished.</p> <p>4.13 If adjustments need to be made to the front MM5 position, click on Edit function of the method once the method has terminated, or from the bar at the bottom, click on the method in the Edit mode.</p> <p>4.14 The method will appear in the Edit mode. Go under the Edit drag down window and click on Device.</p> <p>4.15 An Edit Device window will open. Highlight the MM5 Shaker Front and double click or click on the Edit button after highlighting.</p> <p>4.16 In Labware Position Difference box, there will be an X offset, a Y offset and a Z offset. Decreasing the X offset will move the tips to the left, decreasing the Y offset (numbers can be reduced to become increasingly more negative) will move the tips back, away from the front of the deck, and reducing the Z offset will bring the tips lower. It is best to make small increments (± 0.4) until it can be evaluated just how much the tip alignment needs to be adjusted.</p> <p>4.17 Once the changes have been made, click OK. The window will close and the Edit device window will still be open. Click Close.</p> <p>4.18 Initiate the shaker alignment method again and repeat the steps. If the tip alignments appear centered for the X and Y axes and the wobble room is sufficiently small for the Z axis, then quit the method unless adjustments need to be made at the Shaker Heat Block position. If adjustments need to be made to any of the axes, then repeat the process described above until the tips are appropriately aligned.</p> <p>4.19 To align tips for the Shaker Heat Block, in the Edit mode, under the Edit pull down window, select Device.</p> <p>4.20 From the list of devices, highlight the Shaker Heat Block and double click on the Edit button.</p> | |

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| <div> <div> <p>4.21 A window will open. Look for the Labware Position Difference box (on right) and again there will be an X, Y and Z axis. Changes to the values for each axis produce the same tip alignment adjustments as described in step 4.17.</p> <p>4.22 Make the adjustments to the appropriate axes, then click on OK.</p> <p>4.23 Click Close for the Edit Device window.</p> <p>4.24 Initiate the alignment method again and let it quickly run through the MM5 Front R position.</p> <p>4.25 Once the tips are airborne, moving to the Greiner plate sitting on the thermal exchange unit (Shaker Heat Block), click Stop and then twice on the Trace button and evaluate the tip alignment for all three axes. If the alignment is good, then click Continue and let the method complete and the alignment will be finished. Otherwise, go under Edit and continue to make the necessary alterations to the X, Y or Z axes until the tips are properly alignment (defined in step 4.9) in the Greiner plate wells at the Shaker Heat Block position.</p> </div> <div> <p align="right">◆END</p> </div> </div> | |